

## **Appendix 9 – Equipment Engine 57 Analysis Summary**

### ***Engine 57, Vehicle 6652***

#### **Documented History of Vehicle 6652 Maintenance History:**

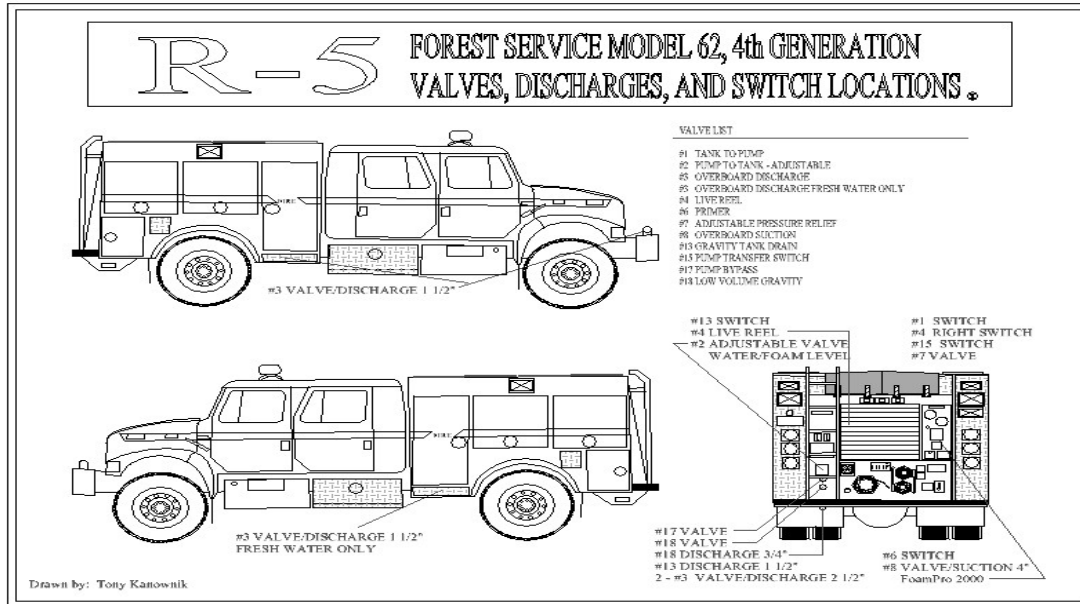
From Vehicle History Files and Fleet Management Vehicle Maintenance Data Base:

#### **General Information:**

- Forest Service Equipment number 6652, Class 949, Model 62, BDF Engine 57
- 2001 International Model 4900 4X2 Crew Cab
- In service October 29, 2001
- VIN 1HTSDADN21H393451
- License Plate number A290230
- DT-530 300 Horsepower Turbocharged Diesel Engine
- 6-Speed Allison Automatic Transmission with Auxillary Brake Retarder
- GVWR 33,000
- Capitalized Value: \$158,482.
- Current Documented Mileage 34,156 (10/22/2006)
- Fire apparatus built on a Government provided chassis by Boise Mobile Equipment, Boise Idaho.

#### ***Region 5 Standard Fire Engine Information***

- Model 62 Fire Engine
- Equipped with 1 each 500 gallon water tank, 2 each 20 gallon Class A foam reservoir
- Dual Foam System, Foam Pro 2001
- Darley JMP-500 2-stage pump



**Equipment Engine Figure 1. ..**

### **Acquisition and Maintenance History:**

09/28/2000	Engine ordered as part Region 5 fire equipment expansion
03/30/2001	International Cab and Chassis delivered to Boise Mobile Eq. in Boise ID.
10/06/2001	Engine accepted and driven to San Bernardino. (1601 miles)
10/09/2001	Vehicle engine coolant change to meet compliance in Southern California
10/12/2001	3 Hoses repaired
10/29/2001	Engine is placed in service as BDF E-57
02/28/2002	Installed Door Pockets
04/17/2002	Modified Exhaust System for more ground clearance
05/20/2002	Transmission service (4558 miles)
06/24/2002	New Engine Status readout for rear panel
10/08/2002	Driving Lamps and brake parts purchased
10/17/2002	Filters purchased
01/29/2003	Annual inspection, valve and lighting work. (13,567 miles)
01/30/2003	Replaced a Hypo Flow Sensor
02/06/2003	Replaced paddle wheel sensor
03/03/2003	Towed to Dietrich International Dealership (13,648 miles)
03/11/2003	Repairs to cooling system at Dietrich International. (13,648 miles)
04/09/2003	Tubing purchased
07/25/2003	Engine status center and pump primer motor replaced
09/29/2003	Replaced 2 tires
12/03/2003	Engine Status readout replaced
02/24/2004	Annual inspection, LOF, pump work and tire replacement (18600 miles)
06/28/2004	Electrical Work at IHC dealership
10/14/2004	Replaced alternator

01/11/2005	Annual inspection, LOF, Trans Service, repaired panel lights (23,161 miles)
01/20/2005	AC repair and misc repair as part of the Annual inspection
01/24/2005	Opacity Test, smoke test (23,207)
03/22/2005	Safety Check by Maintenance Contractor Serco (23,396 miles)
04/26/2005	Repair windshield washer (24,304 miles)
06/01/2005	Repaired headlights (24366 miles)
06/08/2005	Adjust pump packing (24485 miles)
01/09/2006	Annual, LOF (27892 miles)
01/10/2006	Repaired lights, Repair Retarder, (27895 miles)
04/04/2006	Cancelled work order, truck not available to vendor (28,711 miles)
04/07/2006	DOT Level 1 inspections (28,833 miles)
04/11/2006	Service call to repair fuel lines a LA County Station 129
04/20/2006	Service call to Fox Field to repair an axle flange leak.
04/21/2006	Perform DOT Level inspection (29,053 miles) Inspection failed - due to driver's seat cracked.
04/24/2006	Repair front drivers seat base (29,175 miles)
06/02/2006	Perform DOT level 1 inspection.
06/02/2006	DOT level 1 inspection
06/09/2006	Repair Charging System, replace voltage regulator, and replace 1 ½ inch Akron ball valve. (29,350 miles)

### **Facts:**

1. Vehicle 6652 E-57 was in service for 59 months prior to the Esperanza incident. All records kept in the vehicle were destroyed as a result of the vehicle fire. Records used to support vehicle Acquisition and Maintenance history were obtained from the San Bernardino National Forest Fleet Management Office.
2. Maintenance records were complete and indicate that Vehicle 6652 E-57 was in good condition and fully operable as a R5 standard Model 62 Engine. Model 62 engines built since 2001 were equipped with a single hose reel located in the rear compartment. During our inspection of Engine 57, we could not locate the hose reel. The hose reel cabinet was used to store hose packs at the time of the incident.
3. Vehicle 6652 E-57 last recorded odometer reading was taken from the Voyager Fleet Credit Database. On October 22, 2006 at 2235 hours the vehicle's current mileage was entered as 34,156 miles. A total 22.8 gallons of diesel fuel was purchased in Banning at G&M Oil, LLC #25 030.
4. 6652 E-57 was parked on-scene with the front of the vehicle pointed west.

## ***Condition of Vehicle as we joined the Investigation Team on 10/28/2006 at 4:00 p.m.***

James Little and I, Mike Arias arrived at the site and noted the following facts about the condition of 6652, Engine 57.

6652, Engine 57 was a total loss as a result of a secondary vehicle fire.

All six tires were completely burned with only the steel cords remaining. This allowed the vehicle to settle on its wheels, front axle and rear step bumper.

The high heat also caused distortion in the leaf springs assemblies causing the vehicles suspension to settle further.

### **Rear Control Panel**

Both 2 ½ inch discharge valves were reduced to accept 1 ½ inch fittings and hose. The bottom discharge valve was found open and connected to one hose comprised of two lengths that were partially burned. There was some water remaining in the two lengths of hose.

The rear compartment roll up door appeared to be in the closed position. Contents of the rear compartment appeared to be 1 ½ inch and 1 inch hose packs. Charred fittings sleeves and nozzles were found in the cabinet, as well as, the bottom area below this cabinet and directly behind the lower control panel.

The upper suction hose storage bins contained two lengths of suction hose, one in the lower left side and one in the lower right. The upper left and right storage bins were used to store a 1 ½ inch hose lays. The hose lay stored in the upper right bin was removed and connected to the bottom discharge at the rear of the engine panel. The hose lay stored in the upper right bin was still stored with the bin door closed.

The upper hose storage deck was completely burned and melted as result of the vehicle fire. The large storage compartment doors were burned. The left side was partially melted and missing while the right storage door was still complete.

The area directly below the top hose storage is where a water and foam tank is positioned on the truck and connected to the plumbing. The water tank is designed to hold approximately 510 gallons of water and within that tank there is also two separate 20 gallon compartments designed to store two types of foam concentrate. The tanks are constructed of polypropylene material. As designed complete sump and fill towers this tank weighed 475 lbs empty. This much poly propylene material once ignited and burning caused extensive heat.

The right rear lower compartment was found with a door. A military ammo can was found in the bottom of this compartment and appeared to contain fusees. A second military ammo can was found on the ground near the truck with two unburned ignition devices. Two empty drip torches were found adjacent to the ammo cans. One drip torch was found with the top separated while the other drip torch was complete.

The upper right rear compartment was severely damaged. The compartment panel was distorted and ripped open from what appears to be an explosion. The door to this compartment was found in two pieces. The outer door panel was found several yards away from the Engine. The inner panel was found adjacent to a tin building that has also burned. Sections of this door frame approximately 150 feet away from the Engine. The interior shelf was partially in place resting on a tool box in the forward end of the cabinet. In this cabinet there were also the remains of a case of Gatorade drinks. Caps and lids were melted off with some liquid still remaining in the plastic bottles. The compartment shelf had the remains of a large medical kit which contained the exploded oxygen bottle found several yards from the truck where the outer door panel was found.

The right side chock block compartment was found with its door in the open position. The chock block was found still in the compartment.

The right middle compartment was found without a door. The compartment door was found on the ground next to the burned wheels. The contents of this cabinet could not be identified, all that remained was melted aluminum and ash.

The right front compartment still had sections of its door frame in place. The inner outer door panels were burned and partially melted. All contents were burned with only the metal components of the tools remained. Items found were flat files, pry bar, bolt cutters, shovel heads, and Pulaski tool heads.

The front bulkhead of the body was completely burned with all the aluminum panels melted away. On this bulkhead, the lower front of the Engine body a 1 ½ discharge valve was found mounted in the closed position and still capped. The hose from the pump to this valve was burned.

On the left side of the bulkhead behind the cab, there were remains of a 1 ½ discharge valve. The valve body was completely melted away. We could only find an inner valve handle collar. The two brackets that support this valve were still in place. There were no remnants of hose found near this side of the Engine.

A small hose lay compartment is located directly below the left front compartment. The door constructed of aluminum appeared to be melted away. No contents found except metal components from hose.

The left front compartment was found without its door. The door was found on the ground. Contents of this cabinet were completely destroyed. The identified contents were five each one gallon water canteen frames. The inner wall of this compartment was

distorted inward to the center of the cabinet. Two fire shelters were found. One shelter was found in the compartment and the other on the ground just below this compartment. Both were where charred and not in their yellow storage bags.

The left center compartment was found without its door. The door was found on the ground under ash and debris. There were some hose fittings remaining in the cabinet. Both shelves were destroyed.

The left rear compartment was found without its door. The door was found on the ground under ash and debris. The contents included a metal bracket and burned turnout gear, helmet and boots.

The left side chock block compartment was found empty. The left side chock block was most likely deployed and melted in the vehicle fire. Chock block was not detected in the melted aluminum material found in the front and rear of the left rear dual wheels.

The left rear lower compartment was found open without its door. There were remains of a metal bracket, ash and debris.

The upper left side boxes accessible from the top we found burned nomex pants. The right side we found a storage box with a tow chain. Other items included a breaker bar, lug wrench, and hydraulic jack.

The area just below the upper storage area was found completely destroyed and collapsed into the area below where the water tank had been. We found two chain saw bars that were stored in the upper storage area. One chain saw motor was found under the truck almost completely melted.

The intense heat of the tank material burning caused the back walls of all left side cabinets to deflect into the cabinet area toward the cabinet doors.

## **Truck Cab**

The 4-door truck cab was found completely burned. The left rear door was found unlatched. All other doors were in the latched position and had to be forced open to investigate the cab area.

All door glass was found shattered and melted in the floor of the cab front and rear.

The back seats were found completely destroyed with the remains of one Self Contained Breathing Apparatus (SCBA) bottle. The only remaining components of the bottles were the fiber material still in its cylindrical shape but reduced to ash. The valves for these bottles were found on the rear seating area floor. The cab roof directly above the rear seats was torn from the cab structure as a result the rear SCBA bottles exploding. The torn section of sheet metal was found on-site approximately 10 yards to the right of the vehicle.

Remains of what appeared to be day packs with personal items were found on the floor of the back seat area. Coins, keys and charred remains of two cell phones.

The front seat area was also completely destroyed. All controls on the dash and radio console were destroyed. The ignition keys were found on the floor between layers of melted window glass.

The truck fuel tank is located on the right side. The 70 gallon diesel fuel tank was still in place approximately 50 percent full. The fuel cap vented as designed.

A SCBA spare bottle storage compartment on the left side directly behind the fuel tank and below the rear cab door was partially burned. This cabinet stores four bottles. One bottle stored at the rear of this compartment was completely destroyed and melted with only the bottle valve remaining. The remaining three bottles were destroyed and still in place.

The left step area below the driver's door was completely burned. Just below the cab is the battery compartment designed to store three batteries. All three batteries were completely destroyed. Just behind the battery storage box an air tank was found with all fittings and hoses burned off. This tank was part of the vehicles air brake system.

The storage box on the left side of the truck just below the left rear door was found completely destroyed and melted. This storage box was designed to house the foam system pump and electric motor. These components were completely destroyed and found in the melted aluminum material on the ground just below the cab.

### **Engine Compartment**

The entire compartment was also destroyed. The only remaining material was fibers that had been reduced to ash from the intense heat. The entire hood and fender assembly was made of fiberglass material except for its mounting hardware and latches.

The vehicle was powered by a six cylinder turbocharged diesel engine. The air cleaner was mounted on the right side in a plastic and metal housing. All that remained of the air cleaner assembly was the metal screens from the air cleaner itself and the metal end caps. A metal ring which is designed as part of an ember separator was found. The screen material attached to this metal ring was not found.

The metal tubing used to deliver air from the air cleaner and air cooler to the turbocharger was found laying on the engine. The rubber connectors were burned and melted. The hose clamps were still in place on the cooler and the turbocharger. These lines were found clean with only a light trace of ash inside.

The turbocharger intake did not seem to be damaged from debris. The turbo shaft turned freely when examined.

The left side on the engine is where an on board Electronic Control Unit (ECU) was mounted. This ECU controls all fuel and electrical functions of the diesel engine. There was only wiring and metal connectors remaining. All circuit boards were destroyed.

The diesel fuel injector pump is also mounted on the left side of the diesel engine. The fuel lines and fuel filter body assembly were severely damaged from the intense heat. The front timing cover on the engine was melted away exposing timing gears. The valve cover on top the engine was burned and melted through exposing the rocker arms and valve train.

We found the engine oil level still at an operational level.

The front radiator, air conditioner condenser and air cooler were destroyed with all hoses and connections burned or melted. The transmission cooler housed in the same area was destroyed.

The automatic transmission was mostly in place however, due to high heat the brake retarder assembly was melted and found on the ground with other melted aluminum.

There was no oil found in the automation transmission. This was a result of the severe meltdown that occurred at the rear of the transmission assembly. The Power Take Off (PTO) gear box is mounted directly to the left side of the transmission. This gear box was still attached to a driveline and would not turn. We removed the PTO driveline and found the PTO engaged indicating the pump was engaged at the time the engine stopped running. The Darley water pump powered by this PTO was found resting on the ground as a result of the entire vehicle settling from the fire.

After we disconnect the pump drive line, we could turn the input shaft of the Darley pump.

The driveline from the rear of the automatic transmission attached to the rear differential was found completely ruptured as a result of high heat.

The rear differential was found resting directly on the ground due to all four tires being burned. The rear springs were collapsed due to the intense heat. This collapse of the rear spring assemblies allowed the truck body to settle down closer to the ground.



## **Conclusion**

All indications are that the truck engine was operating with the pump engaged at the time of the incident.

Based on the condition of all components the truck engine could have shut down due to the following reasons:

1. Interruption of electrical power:  
When the left side battery box and wiring to the ECU were burned.  
High heat causing extensive damage to the operators control panel affecting throttle and water valve controls.
2. Interruption of fuel delivery:  
Burning of fuel lines from the fuel tank and to the left side of the engine where fuel filter assembly and injector pump are located.
3. Interruption of air supply to the diesel engine.

As we inspected the damage to the chassis and the Engine body caused by the vehicle fire, we found evidence that the water tank was near full and that there was some undetermined amount of foam concentrate in the tanks. The polypropylene tank could have been damaged when an oxygen bottle stored in the right side storage compartment exploded. The sheet metal around this cabinet was extremely damaged from the explosion and may have ruptured the tank causing it to drain its contents on the ground. The intense fire burning below the tank caused damage to plumbing connected to the tank sump that is the lowest point of the tank. The area on the right side of Engine 57 showed signs of water flowing on the ground towards the right front of the vehicle then to the right driveway leading to a metal shed. This was observed on Sunday, October 29, 2006 and we could still find damp soil in this area.

On Friday, November 3, 2006, the day we removed Fire Engine 57 we noticed the area directly below the tank to still be damp. Once we removed the melted aluminum and debris from that area the soil was damp and not dry and compacted as it was all around the burned vehicle.

In all Government vehicle disposals it is standard procedure to remove any accountable property. We found that the front license plate had been removed sometime between 4:00 pm on November 2 and 9:00 a.m. on November 3 when we removed the vehicle. We did remove the remains of the rear plate and have it with the vehicle records.

We removed Fire Engine 57, Vehicle 6652 with use of a commercial wrecker and transport truck. We were able to install new wheels and tires on the front axle and tow it to a lower road and load it on the transport. Once loaded, we covered the entire engine with a tarp and towed it to a California Highway Patrol approved impound yard in Indio, California and will hold the vehicle there pending final decisions on disposal of the engine.